Exhibit 5

Volatile Compounds in Foods and Beverages

edited by
HENK MAARSE
TNO-CIVO Food Analysis Institute
Zeist, The Netherlands

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Table 15 Numbers of Constituents in Oregano Oils

Groups of constituents	No. of constituents	
	O. vulgare	T. capitatus
Hydrocarbons	37	20
Alcohols	7	12
Carbonyls	7	10
Acids	4	–
Esters and ethers	5	9
Phenols and derivatives	5	9

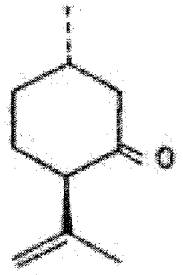
Source: Ref. 34.

Because peppermint oils are of such economic importance, it is not surprising that a tremendous amount of effort has been paid to the chemical composition and the sensory evaluation of these oils.

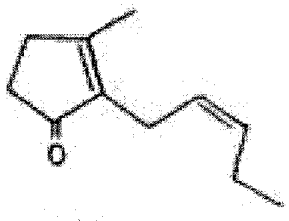
Lawrence [26] reviewed the literature up to 1980 and gave the quantitative chemical composition of two types of American Mentha piperita oils. One of the oils was obtained from immature plants of M. piperita, and the other from the flowers of the same plants. The oil from the flowers contained basically the same constituents, but with dissimilar percentage composition. Lawrence mentioned that some of the minor constituents play an important role in the overall flavor/odor profile. For instance:

Aliphatic esters	Fruity notes
Aldehydes	Green notes
trans-Isopulegone (LVI) and (Z)-jasmone (LVII)	Floral notes
Aliphatic acids	Mellowing notes
Viridiflorol (LVIII)	Sweet notes

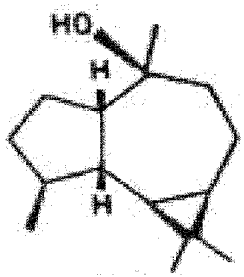
The minty organoleptic quality of peppermint oils is recognized in menthol (IV), menthofuran (LIX), menthone (LX), and mint lactone (LXI).



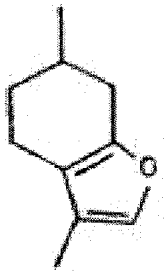
LVI



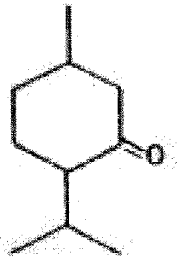
LVII



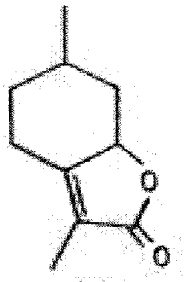
LVIII



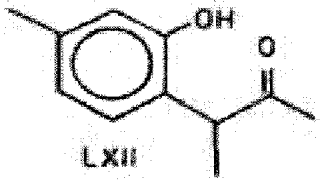
LIX



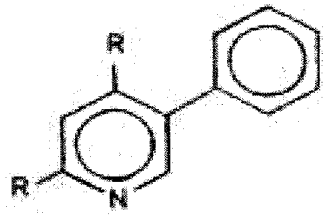
LX



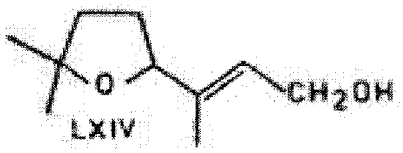
LXI



LXII



LXIII



LXIV

Perhaps the most extensive study of North American peppermint oil was made by Takahashi et al. [64], who identified up to 200 constituents in the oil and quantified about 90 components in concentrations down to 1 ppm, including several previously unidentified constituents. They mentioned as the most important a new keto-alcohol, (+)- and (−)-mint lactone (LXI).

Since 1980, several analyses of peppermint oils have been carried out [37,65–68]. Sakurai et al. [65,66] identified two series of new peppermint oil constituents, 2-(alkanones-3)-5-methylphenols (LXII) and 3-phenylpyridines (LXIII). The first group possesses a faintly fruity, sweet aroma, and the second series displays cinnamon-like, leafy-green, minty, and spicy aromas. Both series of constituents were encountered in several peppermint oils at ppm levels. Moreover, they identified as a new constituent 3-(5',5'-dimethyltetrahydrofuran-2'-yl)-(Z)-2-butenol (LXIV), which has a dry grassy, hay-like aroma, with a floral rosy note.

Summarizing all the publications about the quantitative chemical compositions of peppermint oils, it is scarcely possible to quantify the main groups of constituents because they vary so much in their concentrations. Some examples are:

l-Menthol and epimers	40–60%
l-Menthyl acetate and epimers	5–10%
Menthone	15–40%
Menthofuran	1–10%

Most peppermint oils contain up to 10% monoterpene hydrocarbons, among which β-phellandrene (XLI) is dominant. Cornmint oil contains approximately 80% menthol and 10% menthone [26].

As mentioned before, trace constitutents, even below the ppm level, can have an important influence on the organoleptic quality of peppermint oils.

Updating and reviewing the organoleptic properties mentioned by Lawrence, one may nowadays arrive at the following listing: